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(57) Abstract

The present invention provides a method and apparatus for linking real-time data with audiovisual content to enable a user to make selections, manipulate data, and to execute functions interactively through an audiovisual display unit based upon audiovisual content being displayed at the time. Audiovisual content is synchronized with the available interactive functions so that the user has the ability to interact with and perform functions related to the audiovisual content being shown at the time. In a preferred embodiment, actionable events in audiovisual programs are synchronized with associated overlay functions and interface data. A method is provided to make overlay functions available to the user through an audiovisual display during the actionable events that occur in a program being viewed by the user. A user interface for each overlay function that may be performed, which user interface may or may not be visible to the user, is overlaid on and synchronized with the program being shown. Interaction with selections may be made using any of several known methods such as a screen menu or a cursor controlled by a remote control device.

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INTERACTIVITY WITH AUDIOVISUAL PROGRAMMING

Background of the Invention

1. Field of the Invention:

The present invention relates to the field of interactive audiovisual systems. More particularly, the present invention relates to a method and apparatus for linking real-time data with audiovisual content to enable a user to make selections, manipulate data, and to execute functions by interacting with the audiovisual content being shown at the time.

2. Art Background:

With the development of computer technology, interactive systems are possible that allow users to retrieve data and transact business through various means. Through the telephone, without speaking to a live operator, users can retrieve various types of information, order pay-per-view cable programs, activate credit cards, obtain customer support for products, order movie tickets and listen to and buy musical selections. Using the Internet and commercial online services, users are able to read news reports, view photographs and video clips, listen to sound files, send electronic mail, converse and videoconference in real time with users in remote locations, view sports statistics, buy products, generate maps, and retrieve archived data.

Often a user may decide to use the telephone or an online service to perform such functions based upon programming viewed on television. For example, a user may view a music video on television and then decide to use an automated telephone service or the Internet to order an album by the artist shown. While viewing a football game, a user might be prompted to use the Internet to retrieve statistics for a certain player or team. Users desire to have the ability to perform these functions and new functions using the television instead of having to use a different device such as a computer or telephone.

The advances in digitization and digital compression of data, improvements in transmission media such as fiber optics, and the combination of computer technology with television and audiovisual systems has fostered the development of interactive audiovisual systems. In interactive audiovisual systems, broad bandwidth permits two-way communication, or "interactivity," between the user and a source provider. Such systems allow the user, utilizing a remote control device in conjunction with a set-top box coupled to a cable television, satellite direct broadcast or other communication system, to select a desired movie or program to be viewed, request services and perform other functions such as those that may be performed today using telephones and computer networks. Such systems generally require the user to access such functions by using channels separate from channels on which programming is shown and/or by using menus to access such functions. Often a cursor system is used to allow the user to perform functions using a remote control.

While such systems enable selection of programs and other functions through the television, the selection is not enabled as a function of the content appearing on the television screen. The user must enter a certain mode or otherwise enable a function which is always available to the user upon request. The present invention provides a method for enabling functions only at specified times based upon the content of audiovisual programming being shown to the user at the time. Furthermore, the functions enabled can be made to depend upon the content of the present audiovisual programming, so that the functions can be tailored to specific moments or events in an audiovisual presentation. The present invention presents the user with the ability to interact with the programming by selecting items appearing in the programming shown on the screen with a cursor, by making selections when prompted verbally by an on-screen host, or by other means. It will be understood by those skilled in the art that the present invention may be used for a variety of purposes, some of which are described in detail herein.

Summary of the Invention

The present invention provides a method and apparatus for enabling a user of an interactive audiovisual system to perform functions in real time based upon the content of audiovisual programming being shown to the user at the time ("overlay functions").

The present invention provides a method and apparatus for linking real-time data with audiovisual content to enable a user to make selections, manipulate data, and to execute functions interactively through an audiovisual display unit based upon audiovisual content being displayed at the current time. Put another way, audiovisual content is presented in synchronization with selected overlay functions so that the user has the ability to interact with the audiovisual content by performing said overlay functions associated with selected events that occur in the programming ("actionable events").

A method and apparatus are provided to make overlay functions available to the user through the audiovisual display during the actionable events that occur in programming being viewed by the user. A user interface for each overlay function that may be performed, which user interface may or may not be visible to the user, is overlaid on and synchronized with the programming being shown. Interaction with selections may be made using any of several known methods such as a screen menu or a cursor controlled by a remote control device. For example, while viewing a movie starring a famous celebrity, the set of overlay functions may include the ability to retrieve in an overlay window a list of recent movies starring the celebrity by selecting the celebrity's name during the opening credits of the movie, or whenever the celebrity appears on the audiovisual display. In some instances, a visible cue may exist to indicate that a function may be performed, such as a visible graphical outline appearing on the audiovisual display around an item that may be selected. As another example, during a football program, a user may be able to retrieve a team roster by selecting the name of a team when shown, or the career statistics of a player by selecting that player. As another example, while viewing a television program which reviews current movies, a user would have the ability to access an Internet World Wide Web site for a given movie by making a selection while that movie is being reviewed. As another example, the present invention may be used to implement an audiovisual program guide that allows a user to select programming being shown at the time by giving the user the ability to select one of several areas on the user's television screen, with each of the several areas displaying a different program that is available to the user at the time.

In the present invention, a set of overlay functions ("overlay function set") is associated with each program to be shown to users. The overlay functions could include a variety of retrievable information and interactive functions that will be available to the user

while the user is viewing the program. Each program may have unique overlay function sets since the overlay functions made available are based upon the unique content of each program. For each actionable event in a program, the operator will determine the overlay function set that will be made available to the user, and the characteristics of the interface that will both present the availability of the overlay functions to the user and allow the user to access the overlay functions. Overlay function sets and interface data for a plurality of programs are stored in memory. When a program having overlay function sets and interface data associated with it is sent by the source provider to a user (whether requested on demand, shown at a pre-determined time, or otherwise), the overlay function sets and interface data for the program, which may also be sent by the source provider, are synchronized with the program and loaded into the set-top box. The processor in the set-top box reads the overlay function set and interface data and then both implements the interface and enables the overlay functions in real time and in synchronization with the associated actionable event in the programming. As the user interacts with the program through the synchronized interface, the set-top box implements the relevant overlay functions selected by the user. Alternatively, the set-top box may communicate with the source provider as necessary to implement certain overlay functions selected by the user.

Brief Description of the Drawings

Figure 1 is a functional block diagram of a head end of an interactive television system utilizing the teachings of the present invention.

Figure 2 is a functional block diagram of a remote user location of an interactive audiovisual system utilizing the teachings of the present invention.

Figure 3 shows one possible implementation of synchronization data.

Figure 4 is a flowchart of the detailed process performed by the processing unit in the head end of an interactive audiovisual system in one embodiment of the present invention.

Figure 5 is a flowchart of the detailed process performed by the processing unit in the set-top box in one embodiment of the present invention.

Figure 6 illustrates the basic protocol fields that facilitate the synchronization of overlay function sets and interface data with actionable events.

Detailed Description of the Invention

1. General Considerations

In the present case, the operations described herein are machine operations performed automatically or in conjunction with a human operator. Useful machines for performing the operations of the present inventions include general purpose digital computers, digitally controlled displays, or other similar devices such as set-top box control systems, video on demand servers and the like. The present invention relates to method steps for operating an interactive audiovisual system and processing electrical or other physical signals to generate other desired physical signals.

The present invention also relates to apparatus for performing these operations. This apparatus may be specially constructed for the required purposes or it may comprise general purpose computers selectively activated or reconfigured by computer programs stored in the computers. The method steps presented herein are not inherently related to any particular computer or other apparatus. In particular, various general purpose machines may be used with programs in accordance with the teachings herein, or it may prove more convenient to construct more specialized apparatus to perform the required steps.

Additionally, no particular programming language has been indicated for carrying out the various methods described herein. Each designer of a particular computer, interactive multimedia system, or other display apparatus will be aware of a language which is most suitable for his or her immediate purposes. Because the computers, servers, processing units, set-top boxes and other devices which may be used in practicing the present invention consists of many diverse elements, no detailed program listing has been provided. It is considered that the operations and other procedures described herein and illustrated in the accompanying drawings are sufficiently disclosed to enable one of ordinary skill to practice the present invention.

In a typical interactive audiovisual system, a head-end is coupled to a wire or wireless, analog or digital, communication medium such as cable, satellite, microwave, terrestrial wave or optical fiber, which is in turn coupled to a plurality of users. At the

location of each user, a set-top box is coupled to the communication medium for receiving programming and data from the head end. In some systems it may be necessary for the set-top box to send data back to the head end via the same communication medium or a different communication medium. For example, a satellite signal could be used to transmit programming and data from the head end to the set-top box, while a wire telephony system may be used to send data from the set-top box back to the head end. The set-top box is also coupled to a television or other audiovisual display unit to enable the presentation of programming and data sent from the head end. The set-top box may include a processing unit coupled to a memory and other electronic modules such as decoders, decompressors and audiovisual generators. Computer programming and data files are stored within the memory and accessible by the processing unit. The processing unit generates and displays a graphical user interface on the user's audiovisual display unit, and controls any interactive communication between the user and the head end. Typically the user's system will include a user input device, such as a remote control device, for use in conjunction with the set-top box to enable the user to make selections, change channels and settings, and perform other functions.

2. General System Configuration

One embodiment of the present invention may be described with reference to Figures 1 and 2. Figure 1 is a functional block diagram of a head end of an interactive television system utilizing the teachings of the present invention. Figure 2 is a functional block diagram of a remote user location of an interactive audiovisual system utilizing the teachings of the present invention. In operation, as one of the first tasks in implementing this embodiment of the present invention, the entire length of each program with which users will be able to interact is indexed with sequential code data, which sequential code data may correspond to the elapsed time of each said program during its presentation. For example, the SMPTE time code and the Sony RC time code are well-known in the art as forms of sequential code data. Once the program has been sequentially coded, any actionable event in a program can be uniquely identified by the beginning and ending sequential codes during which the event occurs. It is to be noted that data other than time may be used to index the program sequentially, such as, for example, the number of digital bytes read, the number of film frames elapsed, or some other non-time-based means for counting.

As a next step in implementing the system illustrated in Fig. 1, the program may be viewed by a human operator, before the program is to be transmitted to users, so that the operator may determine and record the sequential codes for the actionable events. For example, in a certain program it may be determined that "silver spaceship appears at sequential codes 1:13:43 through 1:14:17" or, in a hosted program guide, that "the on-screen host discusses Westerns at sequential codes 2:42:02 through 2:48:25." At this point there exists a set of data containing unique indicators for each actionable event in the programming in the form of sequential code data associated with each of those actionable events.

After the actionable events in a given program have been identified using the associated sequential code data, the overlay functions that will be made available to the user and the interface through which the availability of the overlay functions will be presented to the user and through which the user will access the overlay functions, can be created for the program. Instructions to be used by the set-top box to allow the user to select overlay functions will be included as part of the interface data. As one example of the implementation of interface data, user input can be determined by defining a screen area of the user's audiovisual display unit which may be actively selected by a user, and implementing the corresponding overlay function if the user selects the defined screen area using a cursor or some other means for indicating the selection of a certain screen area. For example, the two-dimensional (X, Y) screen coordinates defining a selectable area of the screen may be sent to the set-top box as part of the interface data. Alternatively, the interface data defining a selectable screen area might include the two-dimensional coordinates of a single point on the screen and the radius of a circle centered at the single point. The set-top box may be programmed to generate the areas defined by the interface data. In addition to defining the selectable screen areas, the interface data may also include visual indicators, or overlays, which will appear over the program shown to the viewer during the actionable event to indicate where the selectable screen areas are located. For example, a certain object appearing on the screen may be highlighted in a certain transparent color to indicate to the user that the object may be selected with a cursor to perform an overlay function while the object is highlighted. As another example, the interface data may include a graphical, animated or live-action icon that will appear at a certain area on the screen while the actionable event is occurring. In this example, the location of the icon would coincide with a selectable screen area so that the user may implement an associated overlay function by

selecting the icon. As another example, the interface data may be used to implement an audiovisual program guide that allows a user to select programming being shown at the time. The user's screen may separated into two or more screen areas, with each of the areas displaying a different program, or an icon or other representation of a different program, that is available to the user at the time. As described above, the interface data may include the two-dimensional (X,Y) coordinates of each screen area, as well as a visual indicator, or overlay, which will appear over the selectable screen area coinciding with the position of the user's cursor at the time. When the user moves the cursor to another selectable screen area, the visual indicator would appear over the new selectable screen area, which may then be selected by the user with the cursor to access the programming represented in that selectable screen area.

As another example of the implementation of interface data, the user might perform a function by pressing a special button on a remote control device when a text message generated by the set-top box appears at the bottom of the screen. In such a case, the interface data could include the text message to be displayed, or the interface data may include instructions to the set-top box to generate the text message.

It is to be understood that the interface need not include a graphical overlay to indicate an actionable event. Users may be prompted by other means to perform overlay functions during actionable events. For example, a program may include a speaking host (who may or may not appear on screen) that tells the user which overlay functions may be performed at the time as well as how the user may perform the functions. Alternatively, the interface data may include audio data which is to be heard by the user when overlay functions are enabled.

After the operator has created the interface data and overlay function set that will be made available to the user for a given actionable event, it will be necessary to uniquely associate the interface data and overlay function set with the related actionable event. The interface data and overlay function set for a given actionable event may be uniquely associated with the actionable event by using the same sequential code data to identify the actionable event, the related overlay function set and the related interface data. This may be accomplished by assigning the sequential code data for the actionable event to the related

interface data and overlay function set. By assigning sequential code data to the interface data and overlay function set that matches the sequential code data of the related actionable event, the interface data and overlay function set can be retrieved from memory at the proper time and synchronized with the related actionable event by comparing the sequential code data assigned to the interface data and overlay function set with the current sequential code data during the presentation of the program to the user. Accordingly, it is understood that for each sequentially coded program, synchronization data is created by a human operator which data contains the sequential code data for the actionable events in the programming and the location in memory of interface data and overlay function set to be retrieved and presented to the user when the sequential code data for each actionable event is encountered. Those skilled in the art will understand that the synchronization data may take the form of a look-up table.

Figure 3 shows one way in which synchronization data to be accessed by the processing unit (12) may be structured. In Figure 3, the synchronization data is depicted as a table of addresses of the calls for the overlay function set and interface data associated with each actionable event in a program. It should be understood that additional attributes may be included in the synchronization data shown in Figure 3, such as a subset of user set-top box addresses for which a given actionable event will or will not be actionable. For example, if a certain group of users are not authorized to select overlay functions for a given event, the synchronization data may contain the set-top box addresses for those unauthorized users so that the processing unit can be instructed not to send the overlay function set and interface data for the actionable event to the unauthorized users.

Referring now to head end (2) shown in Figure 1, the first embodiment of the present invention uses sequentially coded programming received at the head end (2) by various means including transmission via satellite (4) from a remote location, or such sequentially coded programming may be stored in signal storage (6) at the head end. It is to be understood that sequentially coded programming may be stored in a variety of formats, including but not limited to MPEG format, DVD, videotape, or other formats. A switcher (8) is provided which switches between the programming sources depending upon which is desired to be transmitted to the user. It is understood by those skilled in the art that the switcher may take many forms. The switcher transmits the sequentially coded program to a signal combiner

(10). It is understood that the signal combiner is well-known in the art and may be a multiplexer, a line inserter or other component.

The sequentially coded program is also transmitted to a processing unit (12), which may include components such as random access memory, processors, co-processors, and interface drivers. Figure 4 illustrates the detailed process performed by the processing unit (12) in the present embodiment. At block (60), the processing unit (12) retrieves the synchronization data for the program from memory (14). The synchronization data is predetermined and may be stored in memory (14) by a human operator or downloaded to memory automatically from the source of the sequentially coded program with which the synchronization data is associated, prior to the transmission of the program. At block (62), the processing unit (12) reads the sequential code data associated with the sequentially coded program. At block (64), the processing unit (12) references the sequential code data to the synchronization data. At block (66), the processing unit (12) determines whether an overlay function set and interface data exist for the current sequential code data (i.e., whether there is an actionable event occurring in the programming). At block (68), if an overlay function set and interface data exist for the sequential code data read by the processing unit (12), the processing unit (12) retrieves the interface data from memory (16) and the overlay function set from memory (18). If an overlay function set and interface data do not exist for the sequential code data being read, the processing unit prepares itself to read the next sequential code data. The overlay function set and interface data is predetermined and may be stored in memories (16 and 18) by a human operator or downloaded to memory automatically from the source of the sequentially coded program with which the synchronization data is associated, prior to the transmission of the program. At block (70), after retrieving the interface data and the overlay function set from memory, the processing unit (12) sends the overlay function set and interface data to the signal combiner (10), which combines the overlay function set and interface data with the sequentially coded program so that the combined signal output by the signal combiner (10) contains the interface data and the overlay function set synchronized with the actionable event identified by the sequential code data read by the processing unit (12). The signal combiner (10) sends the combined signal to the head end transmission equipment (22) for transmission to one or more remote user locations (as shown in Figure 2) via communication medium (30). It is understood that head end transmission equipment may take various forms and is well-known in the art. It should further be

understood that, in this embodiment, the synchronization of the interface data and the overlay function set with the associated actionable event occurs in the head end (2). Alternatively, such synchronization may occur at a remote location from which the synchronized interface data, overlay function set and program may be transmitted to the head end (2) or a plurality of head ends for ultimate transmission to users as further described herein.

It is to be understood that a number of unique protocols may be designed to implement the synchronization of overlay function sets and interface data with actionable events as disclosed in the present invention. Figures 6, 6a, 6b and 6c illustrate basic protocol fields, to be employed in a transport layer, that may be used to facilitate the synchronization process. The signal combiner structures the combined signal as shown in Figure 6. The sequential code data for a given actionable event may be sent first, followed by the overlay function set for the actionable event, followed by the interface data for the actionable event. As shown in Figure 6a, the sequential code data for the actionable event may consist of the start and end codes for the actionable event. As shown in Figure 6b, the overlay function set may consist of the calls to be made by processing units to implement each available overlay function. As shown in Figure 6c, the interface data may consists of screen indicator attributes such as polygon shape, location, format, style and transitions.

The apparatus of the remote user location is shown in detail in Figure 2. The combined signal containing the program, overlay function set and interface data is received at a receiving unit, which may be a set-top box (34) as shown in Figure 2, by a network interface (36) which sends the combined signal to a decoder (38) which separates the program from the overlay function set and interface data sent from the head end (2). The decoder sends the program to a signal combiner (50) which sends the program to the audiovisual display unit (52) for presentation to the user. Simultaneously, the decoder sends the synchronized interface data and overlay function set to a processing unit (40). Figure 5 illustrates the detailed process performed by the processing unit (40) in the present embodiment. At block (72), the processing unit (40) receives the interface data and overlay function set. At block (74), the processing unit (40) reads and formats the interface data. At block (76), the processing unit (40) implements the user interface in accordance with the instructions contained within the interface data, including sending visual, audible, textual, and other material to the signal combiner (50) for presentation to the user in synchronization with

the actionable event being sent to the audiovisual display unit (52). At block (78), the processing unit (40) simultaneously reads the overlay function set and enables overlay functions in synchronization with the actionable event being sent to the audiovisual display unit (52) so that the user is able to implement the various overlay functions. The user may implement those functions by making selections using a remote control device (48) which transmits input signals to a control interface (46) coupled to the processing unit (40). At block (80), the processing unit (40) determines whether the user has selected an overlay function. At block (82), if the user has selected an overlay function, the processing unit (40) causes the selected overlay function to be performed. One or more of the overlay functions selected by the user may be performed in the set-top box (34) by the processing unit (40), which may include components such as interface drivers, processors, and co-processors and may include random access memory (42) capable of running applications that may be accessible as part of the overlay functions available to the user. Such applications may be pre-loaded in the set-top box or downloaded from the head end as needed. Alternatively, one or more of the overlay functions selected by the user may be performed at the head end (2) or other remote location. Signals received from the user at the control interface (46) by the processing unit (40) may be sent through the network interface (36) via communication medium (32) to a transaction processor (24) located at the head end (2), which causes the implementation of the overlay functions. It should be understood at this point that communication medium (32) and communication medium (30) may be the same medium or they me be different. For example, communication medium (30) may be a satellite signal, while communication medium (32) may be electrical wire, or alternatively, a two-way optical fiber may be used as the sole communication medium between the head end (2) and a plurality of remote user locations. The transaction processor may be coupled to Internet servers (28), databases (26), computer networks and other components to facilitate the implementation of the various overlay functions selected by users. For example, if an overlay function allows the user to connect to a world-wide web site containing information related to an actionable event in the programming being presented, the transaction processor may be connected to an Internet server to allow the user to access the world-wide web site. As another example, if an overlay function allows the user to request to be reminded when a future program is about to begin, the transaction processor may be connected to a computer system set up to store unique user addresses and program reminder information to be sent to such addresses. At block (84), if the user did not select an overlay function, the processing

unit (40) determines whether the current actionable event has ended. If the actionable event has not ended, the processing unit (40) continues to determine whether the user has selected an overlay function. If the actionable event has ended, the processing unit (40) resets and awaits the next actionable event.

In a second embodiment of the present invention, the synchronization of the interface data and the overlay function set with the associated actionable event occurs in the set-top box (34) instead of in the head end (2). In such an embodiment, referring again to Figure 1, the processing unit (12) may determine from data received prior to receiving the sequentially coded program whether overlay function sets and interface data are available for the program (i.e., whether there are one or more actionable events occurring in the programming). If overlay function sets and interface data are available, the processing unit (12) retrieves them from memory (16 and 18) and sends them to the set-top box (34) at some time prior to the transmission of the program to the set-top box (34). The processing unit (12) also retrieves synchronization data from memory (14) which, as further described below, will allow the set-top box (34) to synchronize overlay function sets and interface data with actionable events based upon sequential code data. It is to be understood that the synchronization data, overlay function sets and interface data may be stored with the associated program (in signal storage (6) or in storage at the location from which satellite transmitted programs are transmitted) and transmitted immediately prior to the transmission of the program to the switcher (8) and subsequently to the processing unit (12) and on to the set-top box (34).

The synchronization data, overlay function set and interface data, and the sequentially coded program, are received at the set-top box (34) by network interface (36) coupled to decoder (38). The decoder (38) sends the synchronization data, interface data and overlay function data to a processing unit (40) which stores them in memory (44). The processing unit (40) performs the same process detailed in Figure 4 as described with respect to the first embodiment, whereby the processing unit (40) is programmed to read the sequential code data associated with the program and reference it to the synchronization data stored in memory (44) to determine whether overlay function sets and interface data exist for the sequential code data read by the processing unit (40) (i.e., whether there are actionable events occurring in the programming). If overlay function sets and interface data exist for the sequential code data read by the processing unit (40), the processing unit retrieves the overlay

function sets and interface data from memory (44). The processing unit (40) reads the interface data and implements the user interface in accordance with the instructions contained within the interface data, including sending visual, audible, textual, and other material to the signal combiner (50) for presentation to the user in synchronization with the actionable event being sent to the audiovisual display unit (52). The processing unit (40) also reads the overlay function set and enables overlay functions in synchronization with the actionable event being sent to the audiovisual display unit (52) so that the user is able to implement the various overlay functions.

In a third embodiment of the present invention, it should be appreciated that a program and related interface data and overlay function sets may be stored in transportable media such that actionable events in the programming are synchronized with associated interface data and overlay function sets prior to presentation to a user. In such an embodiment, the synchronization process described in the first embodiment and shown in Figure 1 as occurring in the head end (2) may be performed as described, except that the combined signal which is output by the signal combiner (10) may be stored in storage (20) for later transmission from the head end (2) as already described for the first embodiment, or for transfer to copies of transportable media, such as videotape, compact disc, DVD or other formats. Alternatively, the combined signal which is output by the signal combiner (10) may be transmitted to the remote user location, as described in the first embodiment, and then stored in transportable media by an appropriate recording/playback device (54) coupled to decoder (38) through external device interface (56). As shown in Figure 2, during playback from transportable media by recording/playback device (54), the combined signal is transmitted through external device interface (56) to decoder (38) and is processed as described in the first embodiment presented herein. Although the transmission of the program would originate in the user's home or other remote location from the recording/playback device (54), it would still be possible for one or more of the overlay functions selected by the user to be performed at the head end (2) or other remote location instead of in the set-top box (34). Signals received from the user at the control interface (46) by the processing unit may be sent through the network interface (36) via communication medium (32) to a transaction processor (24) located at the head end (2) or other remote location, which would implement the overlay functions.

In yet another embodiment of the present invention, actionable events for a program may be selected, and interface data and overlay function sets may be created or selected for those actionable events and made available to users, during the transmission of the program. In this embodiment, a human operator using a general purpose computer located at a head end location (2) may select overlay functions and create an interface, or select a pre-existing interface, for a given event that the operator wishes to make actionable for users. After selecting the overlay functions and the interface for the current event which the operator wishes to make actionable, the operator instructs the processing unit (12) in the head end to immediately send the overlay function set and interface data to the signal combiner (10) to be synchronized with the event being transmitted to users at the time. In this embodiment, it is not necessary for the program to be sequentially coded in advance of transmission since the operator determines when the overlay function sets and interface data should be sent to users. Upon receipt at the set-top box (34), the program, the interface data and the overlay function sets are handled in the same fashion as the first embodiment described herein, whereby the overlay function sets and interface data are processed by the processing unit (40) and presented to users immediately.

There has been described novel methods and apparatus for linking real-time data with audiovisual content to enable a user to make selections, manipulate data, and to execute functions by interacting with the audiovisual content being shown at the time. It is evident that those skilled in the art may now make numerous uses and modifications of and departures from the specific embodiments described herein without departing from the inventive concepts. Consequently, the invention is to be construed as embracing each and every novel feature and novel combination of features present in or possessed by the apparatus and methods herein disclosed and limited solely by the spirit and scope of the appended claims.

We claim:

1. A method of implementing an interactive audiovisual system wherein one or more users has the ability to interact with said interactive audiovisual system by making selections while viewing linear programming, said linear programming including one or more actionable events, the method comprising the following steps:

selecting one or more events of said linear programming to be actionable events,

associating, with each of said selected one or more actionable events, one or more overlay functions to be accessible to one or more of said users during such actionable event,

associating, with each of said selected one or more actionable events, interface data for enabling one or more of said users to perform said one or more overlay functions,

providing said linear programming, including said selected one or more actionable events, said associated interface data and said associated one or more overlay functions to one or more of said users such that each of said selected one or more actionable events is synchronized with its associated interface data and its associated one or more overlay functions.

2. The method of Claim 1 wherein said step of providing said linear programming further includes providing said linear programming via a wire network.

3. The method of Claim 1 wherein said step of providing said linear programming further includes the step of providing said linear programming via a wireless network.

4. The method of Claim 1 further including the step of providing said linear programming in an analog format.

5. The method of Claim 1 further including the step of providing said linear programming in a digital format.

6. The method of Claim 1 wherein said step of providing said linear programming further includes the step of providing said linear programming via analog terrestrial signal.

7. The method of Claim 1 wherein said step of providing said linear programming further includes the step of providing said linear programming via digital terrestrial signal.

8. The method of Claim 2 wherein said step of providing said linear programming via a wire network further includes providing said linear programming via a cable network.

9. The method of Claim 1 wherein said step of providing said linear programming further includes the step of providing said linear programming via analog satellite signal.

10. The method of Claim 1 wherein said step of providing said linear programming further includes the step of providing said linear programming via digital satellite signal.

11. The method of Claim 1 wherein said step of providing said linear programming further includes the step of providing said linear programming via analog microwave signal.

12. The method of Claim 1 wherein said step of providing said linear programming further includes the step of providing said linear programming via digital microwave signal.

13. The method of Claim 5 wherein said step of including said linear programming in a digital format includes the step of providing said linear programming in an MPEG format.

14. The method of Claim 1 wherein each of said selected one or more actionable events is synchronized with its associated interface and its associated one or more overlay functions in a location remote from the locations of said users prior to providing said linear programming, including said selected one or more actionable events, said associated interface data and said associated one or more overlay functions to one or more of said users.

15. The method of Claim 14 wherein said location remote from the locations of said users is a head end of an interactive audiovisual system.

16. The method of Claim 1 wherein each of said selected one or more actionable events is synchronized with its associated interface and its associated one or more overlay functions at the individual locations of each of said one or more users after the providing of said linear programming, including said selected one or more actionable events, said associated interface data and said associated one or more overlay functions from a remote location to the individual locations of each of said one or more users.

17. The method of Claim 16 wherein said remote location is a head end of an interactive audiovisual system.

18. The method of Claim 1 wherein each of said selected one or more actionable events is synchronized with its associated interface and its associated one or more overlay functions in a location remote from the locations of said users and stored in transportable media for later playback from said transportable media by appropriate recording/playback devices located at the individual location of each of said one or more users.

19. The method of Claim 1 further including the step of associating with said linear programming, sequential code data for indexing said linear programming during its presentation.

20. The method of Claim 19 wherein said sequential code data corresponds to the elapsed time of said linear programming during its presentation.

21. The method of Claim 19 wherein said step of selecting one or more actionable events of said linear programming includes the step of using said sequential code data to identify said selected one or more actionable events.

22. The method of Claim 19 further including the step of using said sequential code data to identify said selected one or more overlay functions.

23. The method of Claim 19 further including the step of using said sequential code data to identify said interface data.

24. The method of Claim 19 wherein said step of associating, with each of said selected one or more actionable events, one or more overlay functions to be performed by one or more of said users during such actionable event, further includes the step of identifying each of said selected one or more actionable events and the said one or more overlay functions to be associated therewith using the same sequential code data.

25. The method of Claim 19 wherein said step of associating, with each of said selected one or more actionable events, interface data for enabling one or more of said users to perform said one or more overlay functions, further includes the step of identifying each of said selected one or more actionable events and said interface data to be associated therewith using the same sequential code data.

26. The method of Claim 19 wherein said step of associating, with each of said selected one or more actionable events, one or more overlay functions to be performed by one or more of said users during such actionable event, further includes the step of creating synchronization data in which each set of said one or more overlay functions is identified using the same sequential code data used to identify the selected actionable event.

27. The method of Claim 26 wherein said synchronization data is in the form of a look-up table including the addresses of the calls for the overlay function set associated with each actionable event contained in said linear programming.

28. The method of Claim 19 wherein said step of associating, with each of said selected one or more actionable events, interface data for enabling one or more of said users to perform said one or more overlay functions, further includes the step of creating synchronization data in which each such interface data is identified using the same sequential code data used to identify the selected actionable event.

29. The method of Claim 28 wherein said synchronization data is in the form of a look-up table including the addresses of the interface data associated with each actionable event contained in said linear programming.

30. The method of claim 19 wherein said step of providing said linear programming, including said selected one or more actionable events, said associated interface data and said associated one or more overlay functions to one or more of said users such that each of said selected one or more actionable events is synchronized with its associated interface data and its associated one or more overlay functions, further includes the steps of referencing said sequential code data to synchronization data for said linear programming to determine whether interface data and one or more overlay functions exist for the current sequential code data, and providing any such existing interface data and overlay functions for combination with the actionable event for the current sequential code data, such that each of said selected one or more actionable events is synchronized with its associated interface data and its associated one or more overlay functions.

31. The method of Claim 30 wherein said synchronization data is in the form of a look-up table including the addresses of the calls for the overlay function set and interface data associated with each actionable event contained in said linear programming.

32. The method of Claim 1 wherein said one or more overlay functions include the capability to retrieve data.

33. The method of Claim 1 wherein said one or more overlay functions include the capability to connect to the Internet, on-line services, databases, and other real-time transactional processing systems.

34. The method of Claim 1 wherein said one or more overlay functions include the capability to request the immediate receipt of programming.

35. The method of Claim 1 wherein said one or more overlay functions include the capability to schedule the receipt of programming at a later time.

36. The method of Claim 1 wherein said one or more overlay functions include the capability to schedule the recording of programming at a later time.

37. The method of Claim 1 wherein said one or more overlay functions include the capability to order products and/or services.

38. The method of Claim 1 wherein said one or more overlay functions include the capability to input data.

39. The method of Claim 1 wherein said interface data includes text, audible items, and/or static, animated or live-action visual items.

40. The method of Claim 1 wherein said interface data includes screen coordinates for areas of a user's audiovisual display unit.

41. A method of implementing an interactive audiovisual system wherein one or more users has the ability to interact with said interactive audiovisual system by making selections while viewing linear programming, said linear programming including one or more actionable events, the method comprising the following steps:

associating with said linear programming, sequential code data for indexing said linear programming during its presentation.

selecting one or more events of said linear programming to be actionable events,

identifying said selected one or more actionable events using said sequential code data,

associating, with each of said selected one or more actionable events, one or more overlay functions to be accessible to one or more of said users during such actionable event by identifying each of said selected one or more actionable events and the said one or more overlay functions to be associated therewith using the same sequential code data,

associating, with each of said selected one or more actionable events, interface data for enabling one or more of said users to perform said one or more overlay functions by identifying each of said selected one or more actionable events and said interface data to be associated therewith using the same sequential code data,

providing said linear programming, including said selected one or more actionable events, said associated interface data and said associated one or more overlay functions to one or more of said users.

42. The method of Claim 41 wherein said sequential code data corresponds to the elapsed time of said linear programming during its presentation.

43. An interactive audiovisual system for providing, and enabling one or more users to interact with linear programming, said linear programming including selected one or more actionable events each having an overlay function set and interface data associated therewith, and said linear programming being provided such that each of said selected one or more actionable events is synchronized with its associated overlay function set and its associated interface data, the apparatus comprising the following:

a signal source for providing said linear programming,

a processing unit, coupled to said signal source, which is programmed to provide said interface data and said overlay function sets associated with said one or more actionable events,

memory means, coupled to said processing unit, for storing said overlay function sets and said interface data,

a signal combiner, coupled to said signal source and said processing unit, for combining said linear programming and said interface data and overlay function sets,

transmitting means, coupled to said signal combiner, for transmitting a signal comprising said linear programming in combination with said interface data and said overlay function sets to one or more users at remote locations,

one or more receiving units for receiving said signal from said transmitting means, each said receiving unit comprising,

decoding means for separating said linear programming from said interface data and said overlay function sets,

a second processing unit, coupled to said decoding means, which is programmed to read and format said interface data and to enable said overlay function sets associated with said one or more actionable events,

memory means, coupled to said second processing unit, for storing said overlay function sets and said interface data,

a second signal combiner, coupled to said decoding means and said second processing unit, for combining said linear programming and said interface,

an audiovisual display, coupled to each said receiving unit, for receiving said linear programming in combination with said interface from said second signal combiner for presentation to each said user,

input means, coupled to each said receiving unit, allowing each said user to select said one or more overlay functions when presented to said user.

44. The apparatus of Claim 43 further including a transaction processor coupled to each said receiving unit, for processing overlay functions selected by each said user.

45. The apparatus of Claim 43 wherein said receiving unit is a set-top box.

46. The apparatus of Claim 43 wherein said input means is a remote control device or a keyboard.

47. A head end of an interactive audiovisual system for providing, and enabling one or more users to interact with, linear programming, said linear programming including selected one or more actionable events each having an overlay function set and interface data associated therewith, and said linear programming being provided such that each of said selected one or more actionable events is synchronized with its associated overlay function set and its associated interface data, the apparatus comprising the following:

a signal source for providing said linear programming,

a processing unit, coupled to said signal source, which is programmed to provide said interface data and said overlay function sets associated with said one or more actionable events,

memory means, coupled to said processing unit, for storing said overlay function sets and said interface data,

a signal combiner, coupled to said signal source and said processing unit, for combining said linear programming and said interface data and overlay function sets,

transmitting means, coupled to said signal combiner, for transmitting a signal comprising said linear programming in combination with said interface data and said overlay function sets to one or more users at remote locations.

48. A receiving unit for receiving a signal comprising linear programming including selected one or more actionable events each having an overlay function set and interface data associated therewith, and said linear programming being provided such that each of said selected one or more actionable events is synchronized with its associated overlay function set and its associated interface data, each said receiving unit comprising,

decoding means for separating said linear programming from said interface data and said overlay function sets,

a processing unit, coupled to said decoding means, which is programmed to read and format said interface data and to enable said overlay function sets associated with said one or more actionable events,

memory means, coupled to said processing unit, for storing said overlay function sets and said interface data,

a signal combiner, coupled to said decoding means and said second processing unit, for combining said linear programming and said interface data,

input means for allowing each said user to select said one or more overlay functions when presented to said user, and

output means for transmitting said combined linear programming and interface data to an audiovisual display for presentation to each said user.

49. An interactive audiovisual system for providing, and enabling one or more users to interact with, linear programming, said linear programming including selected one or more actionable events, identified using sequential code data, each having an overlay function set and interface data associated therewith by identifying each of said selected one or more actionable events and said overlay function set and said interface data to be associated therewith using the same sequential code data, the apparatus comprising the following:

a signal source for providing said linear programming,

a processing unit, coupled to said signal source, which is programmed to read said sequential code data and provide said interface data and said overlay function sets associated with said one or more actionable events,

memory means, coupled to said processing unit, for storing said overlay function sets and said interface data,

a signal combiner, coupled to said signal source and said processing unit, for combining said linear programming and said interface data and overlay function sets,

transmitting means, coupled to said signal combiner, for transmitting a signal comprising said linear programming in combination with said interface data and said overlay function sets to one or more users at remote locations,

one or more receiving units for receiving said signal from said transmitting means, each said receiving unit comprising,

decoding means for separating said linear programming from said interface data and said overlay function sets,

a second processing unit, coupled to said decoding means, which is programmed to read and format said interface data and to enable said overlay function sets associated with said one or more actionable events,

memory means, coupled to said second processing unit, for storing said overlay function sets and said interface data,

a second signal combiner, coupled to said decoding means and said second processing unit, for combining said linear programming and said interface,

an audiovisual display, coupled to each said receiving unit, for receiving said linear programming in combination with said interface from said second signal combiner for presentation to each said user,

input means, coupled to each said receiving unit, allowing each said user to select said one or more overlay functions when presented to said user.

50. The apparatus of Claim 49 further including a transaction processor coupled to each said receiving unit, for processing overlay functions selected by each said user.

51. The apparatus of Claim 49 wherein said receiving unit is a set-top box.

52. The apparatus of Claim 49 wherein said input means is a remote control device or a keyboard.

53. An interactive audiovisual system for providing, and enabling one or more users to interact with, linear programming, said linear programming including selected one or more actionable events, identified using sequential code data, each having an overlay function

set and interface data associated therewith by identifying each of said selected one or more actionable events and said overlay function set and said interface data to be associated therewith using the same sequential code data, the apparatus comprising the following:

a signal source for providing said linear programming and said overlay function sets and said interface data,

a processing unit, coupled to said signal source, which is programmed to provide said interface data and said overlay function sets associated with said one or more actionable events,

transmitting means for transmitting a signal comprising said linear programming, said interface data and said overlay function sets to one or more users at remote locations,

one or more receiving units for receiving said signal from said transmitting means, each said receiving unit comprising,

decoding means for receiving said linear programming and said interface data and said overlay function sets,

a second processing unit, coupled to said decoding means, which is programmed to read said sequential code data, to read and format said interface data and provide said interface based upon said sequential code data, and to enable said overlay function sets associated with said one or more actionable events based upon said sequential code data,

memory means, coupled to said second processing unit, for storing said overlay function sets and said interface data.

a second signal combiner, coupled to said decoding means and said second processing unit, for combining said linear programming and said interface,

an audiovisual display, coupled to each said receiving unit, for receiving said linear programming in combination with said interface from said second signal combiner for presentation to each said user,

input means, coupled to each said receiving unit, allowing each said user to select said one or more overlay functions when presented to said user.

54. The apparatus of Claim 53 further including a transaction processor coupled to each said receiving unit, for processing overlay functions selected by each said user.

55. The apparatus of Claim 53 wherein said receiving unit is a set-top box.

56. The apparatus of Claim 53 wherein said input means is a remote control device or a keyboard.

57. An apparatus for recording linear programming with which one or more users will be able to interact, said linear programming including selected one or more actionable events each having an overlay function set and interface data associated therewith, and said linear programming being provided such that each of said selected one or more actionable events is synchronized with its associated overlay function set and its associated interface data, the apparatus comprising the following:

a signal source for providing said linear programming,

a processing unit, coupled to said signal source, which is programmed to provide said interface data and said overlay function sets associated with said one or more actionable events,

memory means, coupled to said processing unit, for storing said overlay function sets and said interface data,

a signal combiner, coupled to said signal source and said processing unit, for combining said linear programming and said interface data and overlay function sets,

recording means, coupled to said signal combiner, for recording said linear programming in combination with said interface data and said overlay function sets.

58. An apparatus for recording linear programming with which one or more users will be able to interact, said linear programming including selected one or more actionable events each having an overlay function set and interface data associated therewith, and said linear programming being provided such that each of said selected one or more actionable events is synchronized with its associated overlay function set and its associated interface data, the apparatus comprising the following:

a signal source for providing said linear programming,

a processing unit, coupled to said signal source, which is programmed to provide said interface data and said overlay function sets associated with said one or more actionable events,

memory means, coupled to said processing unit, for storing said overlay function sets and said interface data,

a signal combiner, coupled to said signal source and said processing unit, for combining said linear programming and said interface data and overlay function sets,

transmitting means, coupled to said signal combiner, for transmitting a signal comprising said linear programming in combination with said

interface data and said overlay function sets to one or more users at remote locations,

one or more receiving units for receiving said signal from said transmitting means,

recording means, coupled to said one or more receiving units, for recording said signal comprising said linear programming in combination with said interface data and said overlay function sets.

59. An apparatus for enabling a user to play back from storage recorded linear programming with which one or more users will be able to interact, said linear programming including selected one or more actionable events each having an overlay function set and interface data associated therewith, and said linear programming being provided such that each of said selected one or more actionable events is synchronized with its associated overlay function set and its associated interface data, the apparatus comprising the following:

playback means for accessing said stored linear programming and associated overlay function set and associated interface data,

a receiving unit coupled to said playback means, each said receiving unit comprising,

decoding means for separating said linear programming from said interface data and said overlay function sets,

a processing unit, coupled to said decoding means, which is programmed to read and format said interface data and to enable said overlay function sets associated with said one or more actionable events,

memory means, coupled to said second processing unit, for storing said overlay function sets and said interface data,

a signal combiner, coupled to said decoding means and said processing unit, for combining said linear programming and said interface,

an audiovisual display, coupled to said receiving unit, for receiving said linear programming in combination with said interface from said signal combiner for presentation to each said user,

input means, coupled to said receiving unit, allowing said user to select said one or more overlay functions when presented to said user.

60. The apparatus of Claim 59 further including a transaction processor coupled to each said receiving unit, for processing overlay functions selected by each said user.

61. The apparatus of Claim 59 wherein said receiving unit is a set-top box.

62. The apparatus of Claim 59 wherein said input means is a remote control device or a keyboard.

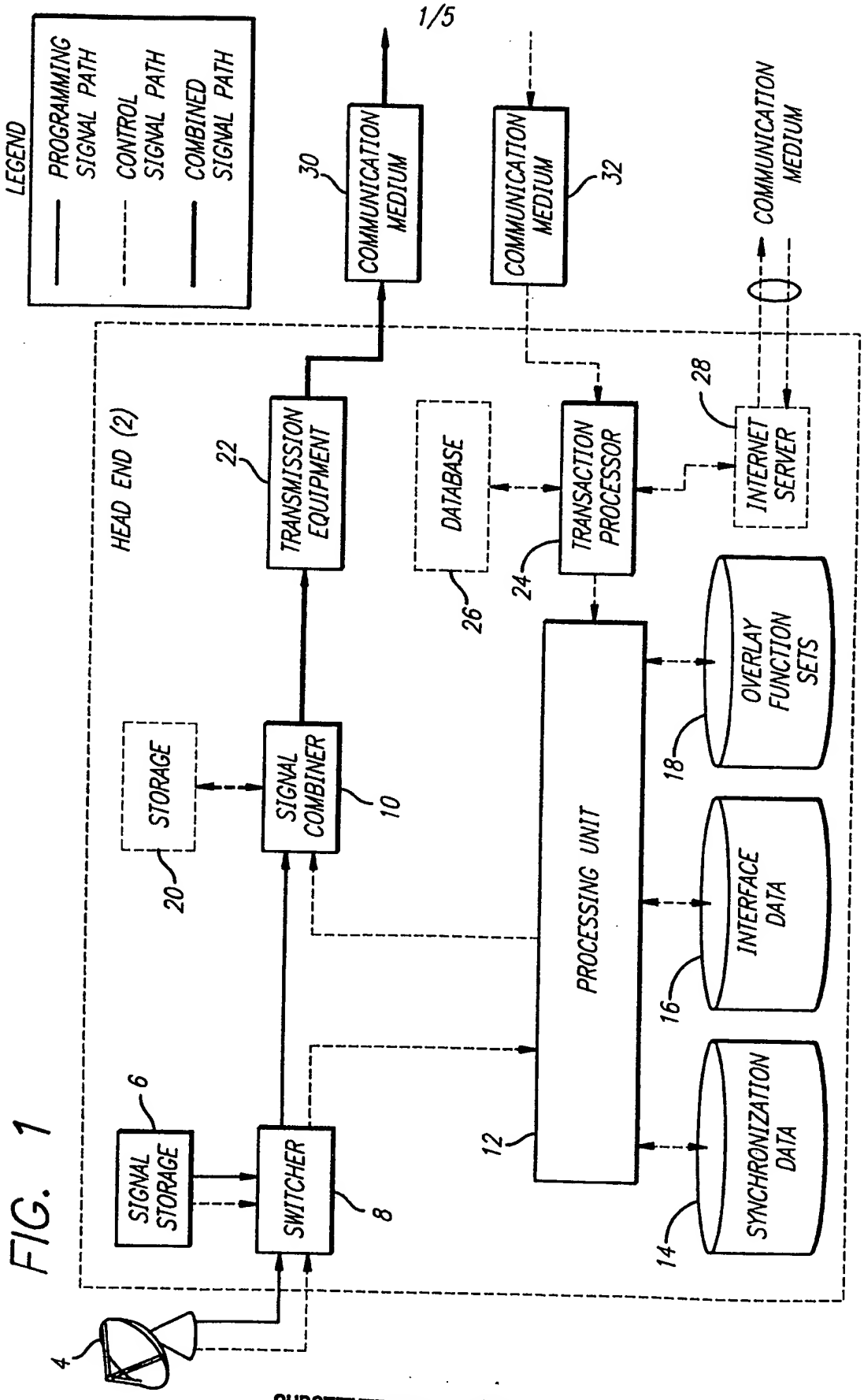

LEGEND
PROGRAMMING SIGNAL PATH
CONTROL SIGNAL PATH
COMBINED SIGNAL PATH
30
COMMUNICATION MEDIUM
32
COMMUNICATION MEDIUM
COMMUNICATION MEDIUM
HEAD END (2)
22
TRANSMISSION EQUIPMENT
DATABASE
26
TRANSACTION PROCESSOR
24
28
INTERNET SERVER
STORAGE
20
SIGNAL COMBINER
10
PROCESSING UNIT
12
OVERLAY FUNCTION SETS
18
INTERFACE DATA
16
SYNCHRONIZATION DATA
14
6
SIGNAL STORAGE
SWITCHER
8
4

FIG. 1

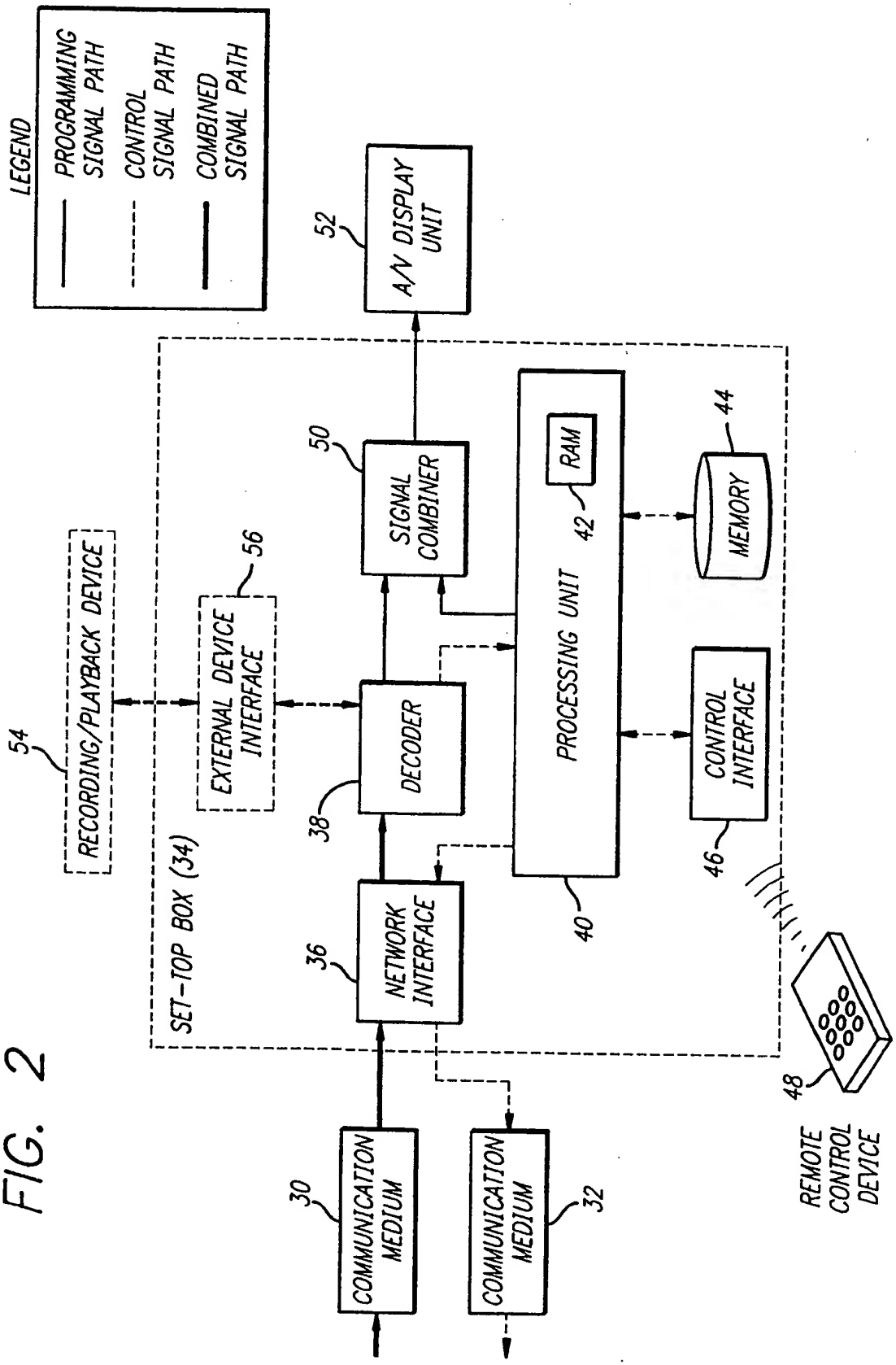

LEGEND
PROGRAMMING SIGNAL PATH
CONTROL SIGNAL PATH
COMBINED SIGNAL PATH
52
A/V DISPLAY UNIT
50
SIGNAL COMBINER
RAM
42
44
MEMORY
PROCESSING UNIT
56
EXTERNAL DEVICE INTERFACE
54
RECORDING/PLAYBACK DEVICE
38
DECODER
CONTROL INTERFACE
46
SET-TOP BOX (34)
36
NETWORK INTERFACE
40
48
REMOTE CONTROL DEVICE
30
COMMUNICATION MEDIUM
32
COMMUNICATION MEDIUM

FIG. 2

FIG. 3

ACTIONABLE EVENT RANGE	OVERLAY FUNCTION SET ADDRESSES	INTERFACE DATA ADDRESSES
00:08:32:05–00:12:15:32	X00013256 X00013368 X00014262 X00017350	X00002426 X00002854
00:35:12:17–00:42:06:27	X00018462 X00018794 X00019236	X00003628

FIG. 4

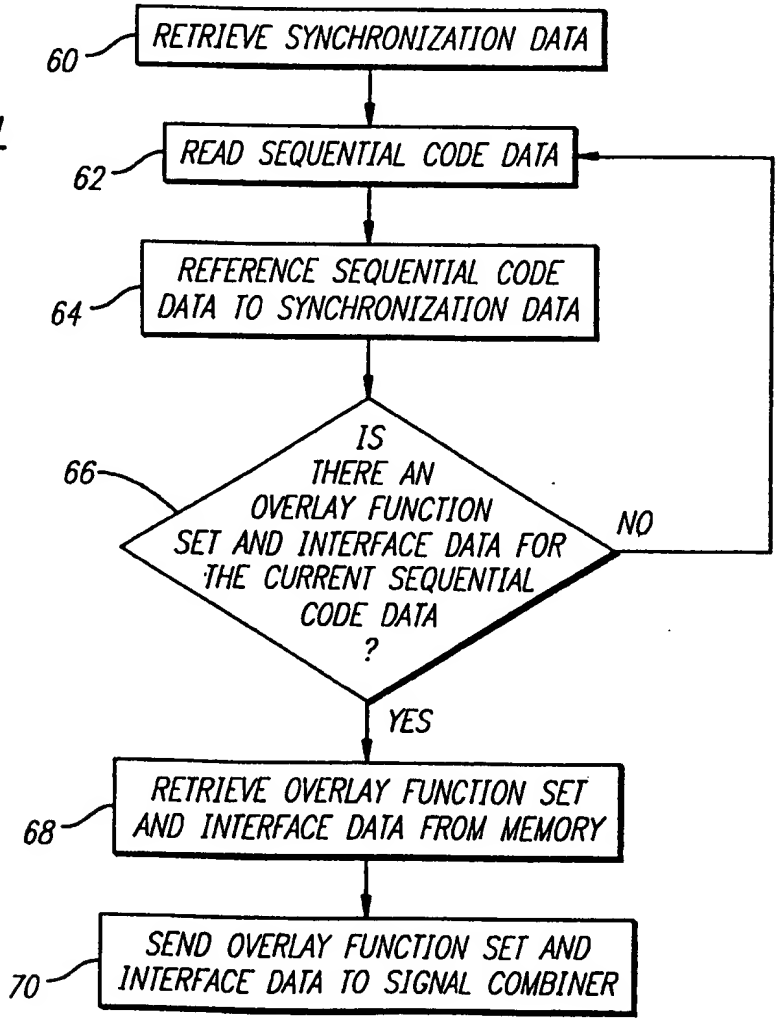


FIG. 5

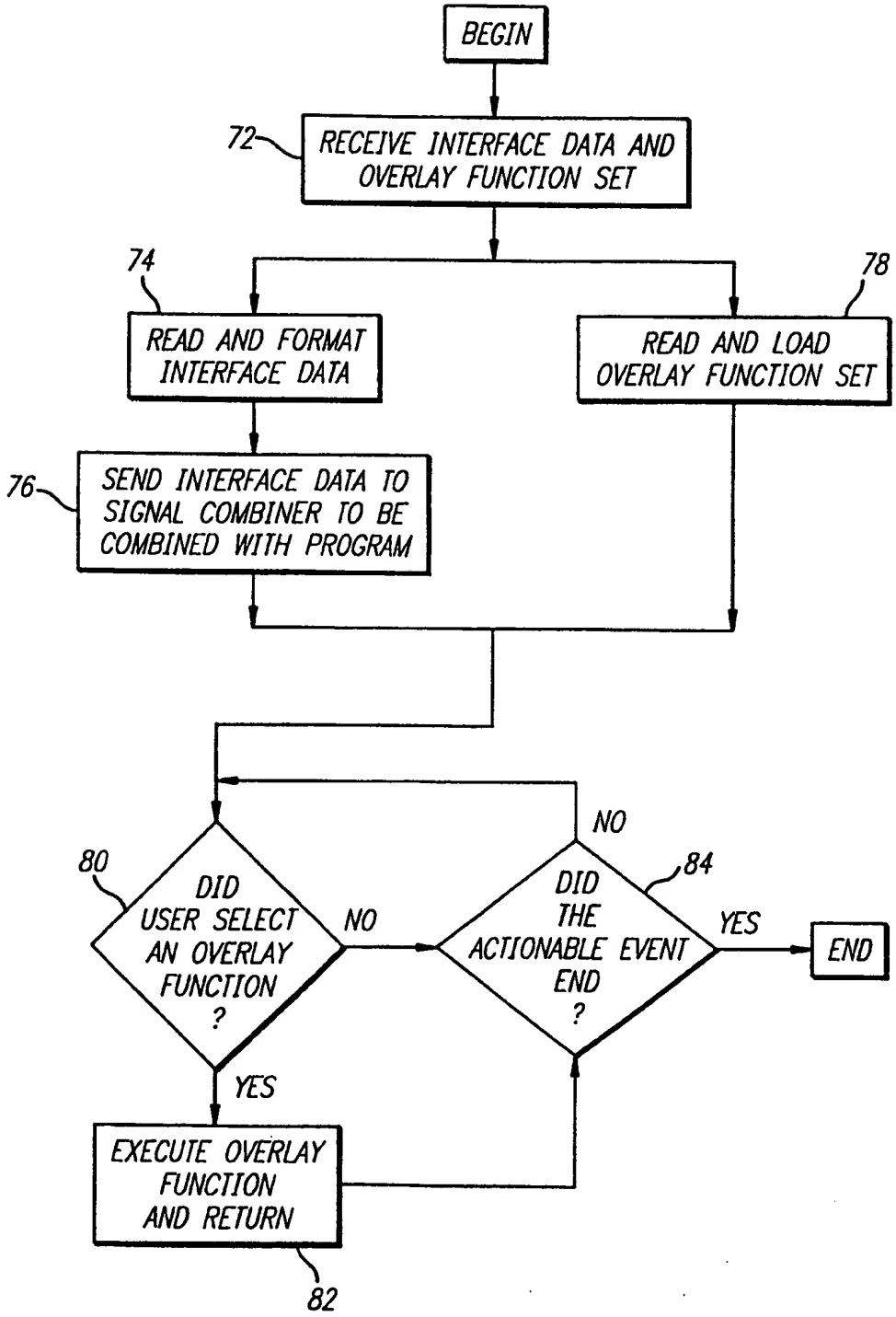

BEGIN
72
RECEIVE INTERFACE DATA AND OVERLAY FUNCTION SET
74
READ AND FORMAT INTERFACE DATA
78
READ AND LOAD OVERLAY FUNCTION SET
76
SEND INTERFACE DATA TO SIGNAL COMBINER TO BE COMBINED WITH PROGRAM
80
DID USER SELECT AN OVERLAY FUNCTION ?
NO
YES
84
DID THE ACTIONABLE EVENT END ?
NO
YES
END
EXECUTE OVERLAY FUNCTION AND RETURN
82

FIG. 6

FIG. 6A

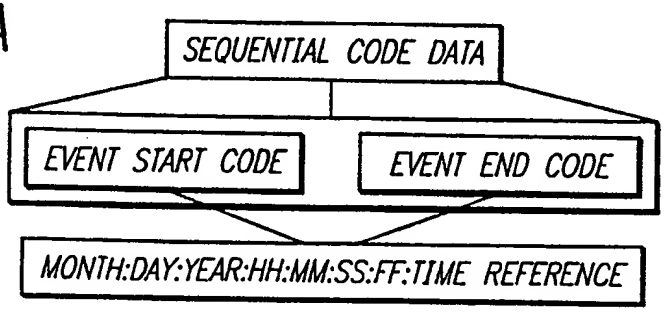


FIG. 6B

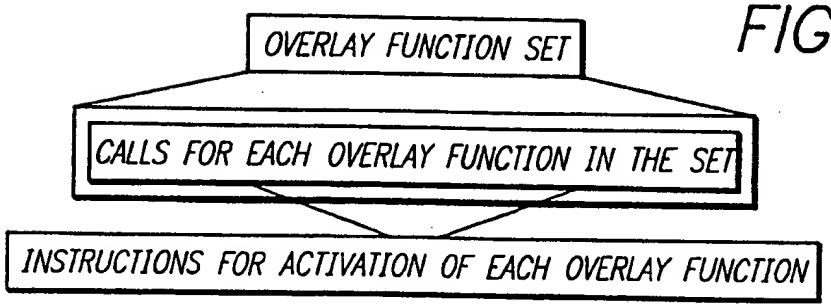
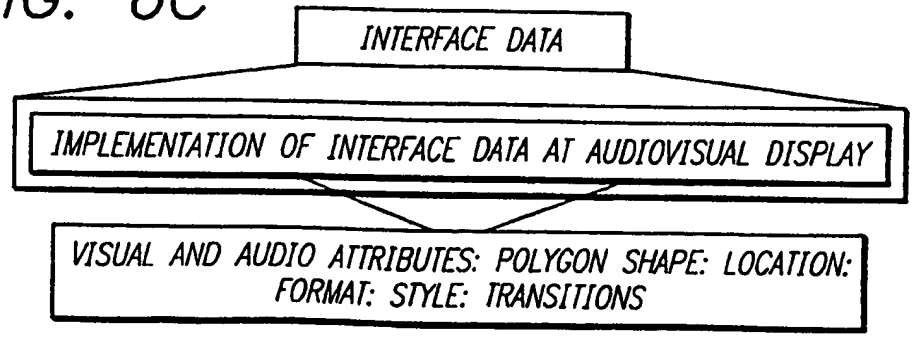


FIG. 6C



INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/US 97/23751

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04N7/173

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 517 257 A (DUNN MATTHEW W ET AL) 14 May 1996 see column 2, line 50 - column 3, line 23 see column 4, line 13 - line 46; figure 2 see column 5, line 47 - column 6, line 2; figure 3 --- -/--	1-17,40, 41, 45-49, 51-53, 55-59, 61,62

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
17 April 1998	27/04/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Fuchs, P

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INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/US 97/23751

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 746 153 A (IBM) 4 December 1996 see abstract see page 2, line 30 - page 4, line 29; figures 1,3 see page 26, line 39 - page 27, line 8; claims 1,2; figures 13-15	1-5,13, 40,41, 43, 47-49, 53,57-59
A	EP 0 711 076 A (AT & T CORP) 8 May 1996 see the whole document	1-17,37, 40,41, 43, 47-49, 53,57-59

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int tional Application No
PCT/US 97/23751

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